

Radiation Design of Ion Mass Spectrometers

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In the harsh radiation environment of Jupiter and with the JUICE mission including two Europa flybys where local intensities are ~ 150 krad/month behind 100 mils of Al shielding, so background from penetrating radiation can be a serious issue for detectors inside an Ion Mass Spectrometer (IMS). This can especially be important for minor ion detection designs. Detectors of choice for time-of-flight (TOF) designs are microchannel plates (MCP) and some designs may include solid state detectors (SSD). The standard approach is to use shielding designs so background event rates are low enough that the detector max rates and lifetimes are first not exceeded and then the more stringent requirement that the desired measurement can successfully be made (i.e., desired signal is sufficiently greater than background noise after background subtraction is made). GEANT codes are typically used along with various electronic techniques, but such designs need to know how the detectors will respond to the simulated primary and secondary radiations produced within the instrument. We will be presenting some preliminary measurements made on the response of MCPs to energetic electrons (20 keV to 1400 keV) using a Miniature TOF (MTOF) device and the High Energy Facility at Goddard Space Flight Center which has Van de Graaff accelerator.